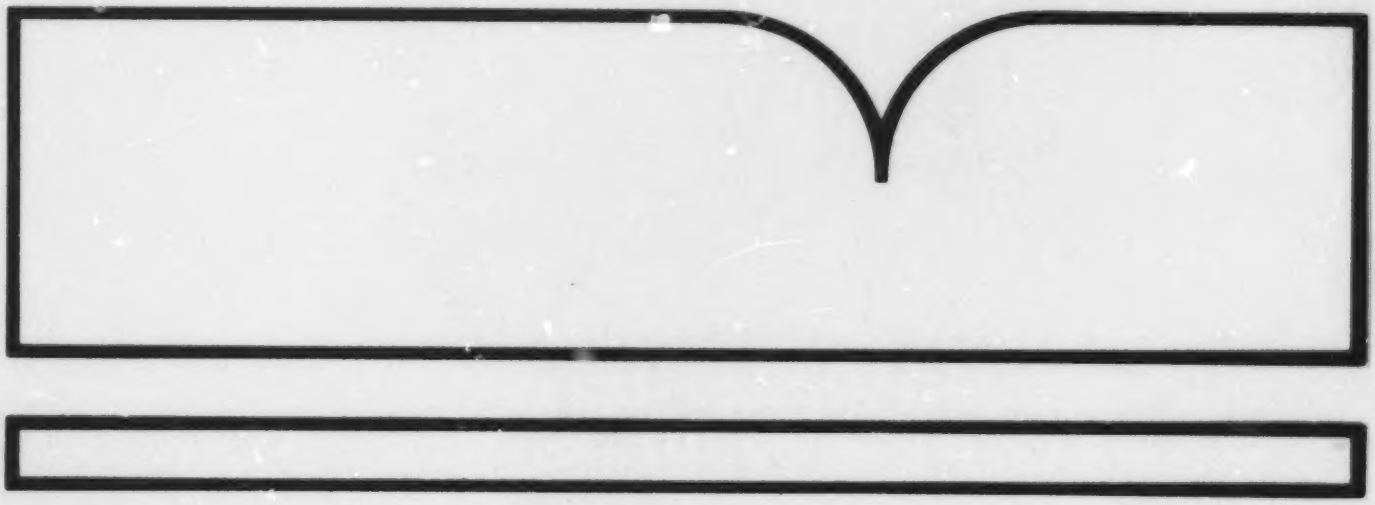
PB86-172509

Superfund Record of Decision (EPA Region 5)
LeHillier/Mankato Site
Mankato, Minnesota, September 1985

(U.S.) Environmental Protection Agency
Washington, DC

27 Sep 85



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EPA/ROD/R05-85/024
September 1985

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EPA

Superfund Record of Decision:

LeHillier/Mankato, MN

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15. SUPPLEMENTARY NOTES

16. ABSTRACT

The LeHillier/Mankato site is located in south-central Minnesota approximately 80 miles southwest of Minneapolis-St. Paul, adjacent to the City of Mankato. The LeHillier area contained numerous natural and manmade depressions resulting from changes in the channels of the Minnesota and Blue Earth Rivers, and from excavation of sand and gravel. Between 1925 and 1960, these depressions were filled with miscellaneous rubbish. No records of the dumping activities or types of waste materials were kept. In the fall of 1981, the Minnesota Pollution Control Agency (MPCA) received information alleging that hazardous wastes had been disposed of at several dumps or fill areas in LeHillier. A followup investigation confirmed the existence of these disposal areas and contamination of the shallow sand and gravel aquifer with volatile halogenated hydrocarbons, primarily trichloroethylene (TCE).

The selected remedial action includes: extraction, with partial treatment by air stripping, of the contaminated ground water plume through adaptation of eight existing U.S. Army Corps of Engineers (COE) ground water and flood control wells and construtution of two new extraction wells; extension of the LeHillier community water system to affected residents and businesses not currently serviced; and proper abandonment, in accordance with State well codes, of individual wells formerly used as drinking water supplies. This action will manage contaminant migration until contaminant levels
(see separate sheet)

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Record of Decision LeHillier/Mankato, MN Contaminated Media: gw, soil Key contaminants: trichloroethylene (TCE)		

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Abstract - continued

reach drinking water quality. Total capital cost for the selected remedial action is estimated to be $800,000 with first year operation and maintenance costs of $70,000. The State of Minnesota will continue O&M for the remaining duration which should not exceed 9 years.

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Record of Decision
Remedial Alternative Selection

Site: LeHillier/Mankato, Mankato, Minnesota

DOCUMENTS REVIEWED

I have reviewed the following documents describing the analysis of cost-effectiveness of remedial alternatives for the LeHillier/Mankato site:

- LeHillier Remedial Investigation;
- LeHillier Feasibility Study; and
- Summary of Remedial Alternative Selection.

DESCRIPTION OF SELECTED ALTERNATIVE

- A system of ten extraction wells with partial treatment by air stripping which aggressively pumps and treats contaminated groundwater over a ten year period or until acceptable levels in groundwater are reached. This system is necessary to effectively control migration of contaminants and protect current and future drinking water supplies for the City of Mankato (Pop. 29,000).
- Extension of the LeHillier community water system to affected residents and businesses not currently serviced.
- Proper abandonment in accordance with State well codes of individual wells formerly used as drinking water supplies.
- The selected alternative has total capital cost of $800,000 and first year operation and maintenance cost of $70,000. The total 10 year present worth is $1.3 million.

DECLARATIONS

Consistent with the Comprehensive Environmental Response, Compensation, and Liability Act, 42 U.S.C. § 9601 (CERCLA) and the National Contingency Plan, 40 CFR Part 300 (NCP), I have determined that the selected remedy is cost-effective and provides adequate protection of public health, welfare, and the environment. The State of Minnesota has been consulted and agrees with the approved remedy. In addition, the action will require future operation and

maintenance activities to ensure the continued effectiveness of the remedy. These activities will be considered part of the approved remedy and eligible for Trust Fund monies for a period of one year. In accordance with section 104(c)(3) of CERCLA, the State is required to ensure the continued operation and maintenance of the selected remedy after the first year.

This action will manage contaminant migration and will control and aggressively reduce continuing sources, if any, until contaminant levels reach drinking water quality. By periodically monitoring groundwater quality, operational data will be used by United States Environmental Protection Agency (U.S. EPA) and the State of Minnesota to evaluate performance and assess the likelihood of reaching our goal of 10^{-6} lifetime cancer risks for trichloroethylene (TCE) [2.8 ppb]. We estimate that our goal can be achieved within a five to ten year period, if any continuing sources are eliminated under this remedial action. If this is not the case, source control actions will be evaluated versus operation of the recommended alternative for a longer period. In addition, the selected remedy is more cost-effective than other remedial action and is necessary to protect public health, welfare, or the environment.

Alan Levin (Acting)

Valdas V. Adamkus
Regional Administrator
Region V

Record of Decision
Remedial Alternative Selection
LeHillier/Mankato, Mankato, Minnesota

SITE LOCATION

The LeHillier/Mankato site is in south-central Minnesota approximately 80 miles southwest of Minneapolis-St. Paul, adjacent to the City of Mankato. The study area, is shown in Figure 1. The southern half includes the residential and industrial area of unincorporated LeHillier and the northern half is a portion of the City of Mankato known as West Sibley Park. The site is crossed by U.S. Highway 169 and the Chicago and Northwestern Railroad. A Ranney collector (water supply well), located at the northeastern edge of West Sibley Park near the confluence of the Minnesota and Blue Earth Rivers, supplies 95 percent of the City of Mankato's daily water requirements.

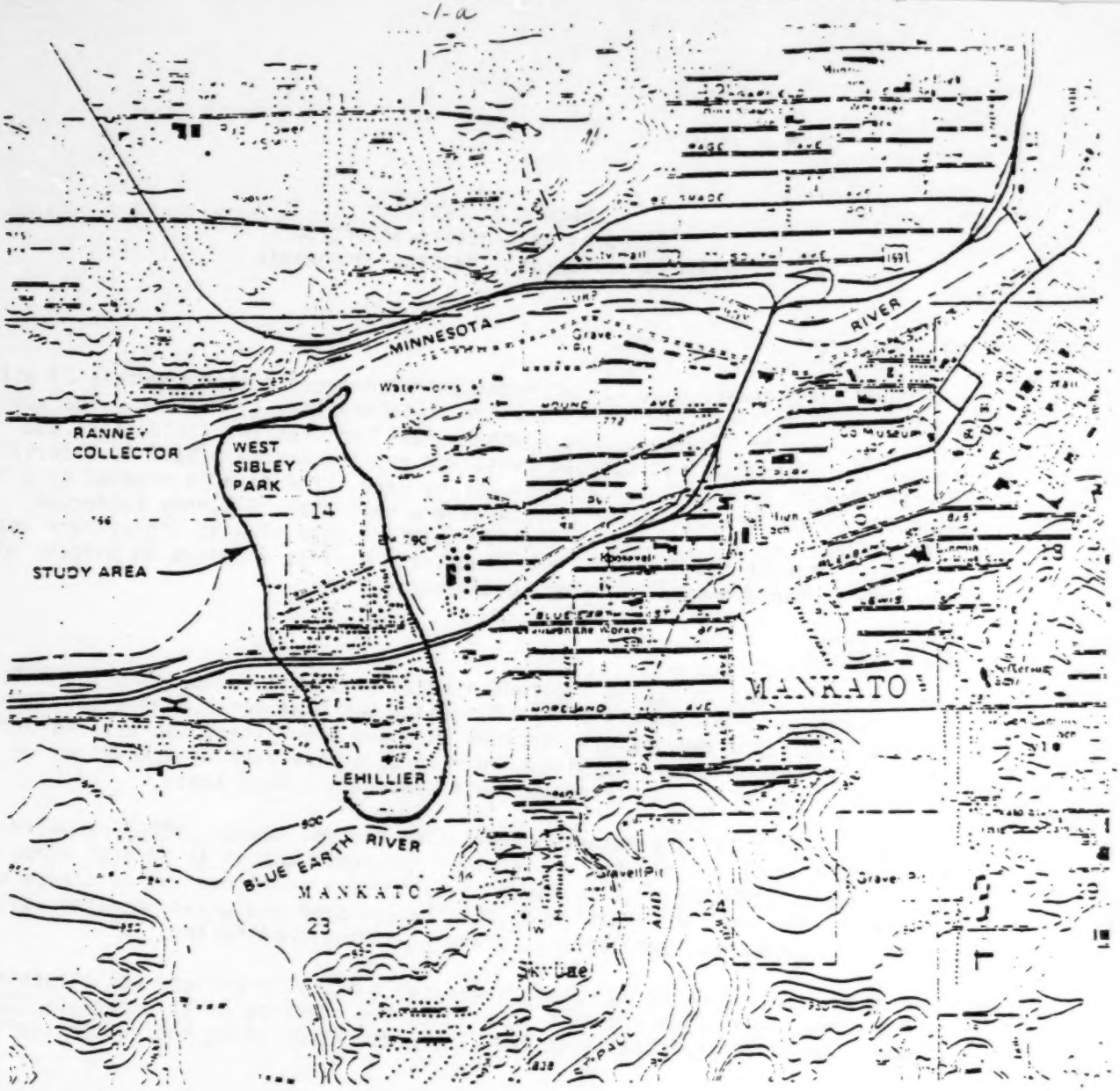
SITE HISTORY

The LeHillier area contained numerous natural and manmade depressions resulting from changes in the channels of the Minnesota and Blue Earth Rivers and from excavation of sand and gravel. Between 1925 and 1960, these depressions were filled with miscellaneous rubbish. No records of the dumping activities or types of waste materials placed in these depressions were kept.

In the fall of 1981, the Minnesota Pollution Control Agency (MPCA) received information which alleged the disposal of hazardous wastes at several dumps or fill areas in LeHillier. A followup investigation confirmed the existence of disposal areas and contamination of the shallow sand and gravel aquifer with volatile halogenated hydrocarbons, primarily trichloroethylene (TCE).

In October 1981, MPCA began monitoring water quality in private wells located in the area. Analytical results identified the presence of an elongated TCE plume which generally paralleled the Blue Earth River along the eastern half of LeHillier.

A bottled water program was instituted by United States Environmental Protection Agency (U.S. EPA) and was continued by MPCA for residents of LeHillier whose well water contained TCE in concentrations greater than 25 ug/l. A Housing and Urban Development (HUD) grant for construction of an alternative groundwater supply well was sought and obtained by Blue Earth County on behalf of the LeHillier community. A deep well was drilled in May and June 1984. The distribution system was completed by the end of 1984. On January 7, 1985, a court order was issued which has been interpreted to make operation of the HUD deep well water supply system contingent upon the installation of a sanitary sewer system. LeHillier is now planning to construct a sewer system within a 5 year period by seeking grants and selling $400,000 of municipal bonds. The City of Mankato has approved operation of the HUD system. Most LeHillier residents are now supplied with a permanent clean water supply.



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SCALE IN FEET

SOURCE: USGS Mankato West Quadrangle Map, 1974

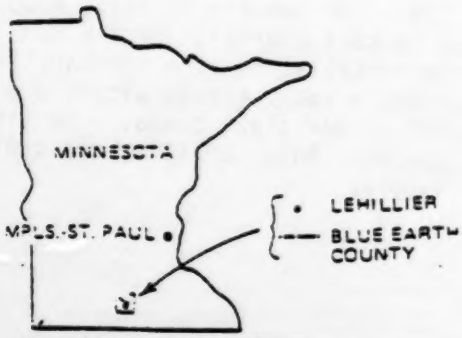

FIGURE 1
LOCATION MAP
LEHILLIER SITE

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During the fall of 1982 and the spring of 1983, U.S. EPA conducted a preliminary field investigation (FIT study) of the site. Monitoring wells were installed and groundwater levels were measured. The general boundaries of the northern half of the contaminant plume were identified based on analytical data for monitoring well samples collected. As of May 1983, the northern edge of the 10 ug/l contour or the contaminant plume was estimated to be approximately 1/4-mile south of the City of Mankato water supply.

Based on the application of the FIT study, the site was scored (59.75) and included by the U.S. EPA on the National Priorities List of uncontrolled hazardous waste sites.

REMEDIAL INVESTIGATION

Although considerable investigation had been done on the area prior to 1984, the existing data base for the LeHillier site was considered insufficient to allow for the selection, screening, and evaluation of remedial action alternatives for onsite or offsite control. To develop the additional data needed, a Remedial Investigation (RI) was implemented (Final Work Plan, May 1984 and the Addendum to the Work Plan, January 1985) and completed.

The primary objectives of the RI were to determine the nature and extent of contamination, acquire site-specific data required to support an exposure assessment under the no action alternative and to support the Feasibility Study (FS).

RI FIELD ACTIVITIES

RI field activities included a number of major tasks:

- Installation of monitoring wells, surface water staff gauging stations, and continuous water level recorders;
- Collection of water level data and testing of hydrogeologic properties;
- Three rounds of groundwater sampling and analysis at private production wells and monitoring wells;
- Drilling of boreholes for sampling analysis of groundwater quality at different depths within the aquifer; and,
- Analysis of samples collected at two suspected source areas.

All field activities with the exception of water level monitoring were performed between August 1984 and April 1985.

NATURE AND EXTENT OF CONTAMINATION

The nature and extent of contamination is shown in Figure 2. The area contained within the 10 ug/l TCE isoconcentration line is approximately 50-acres.

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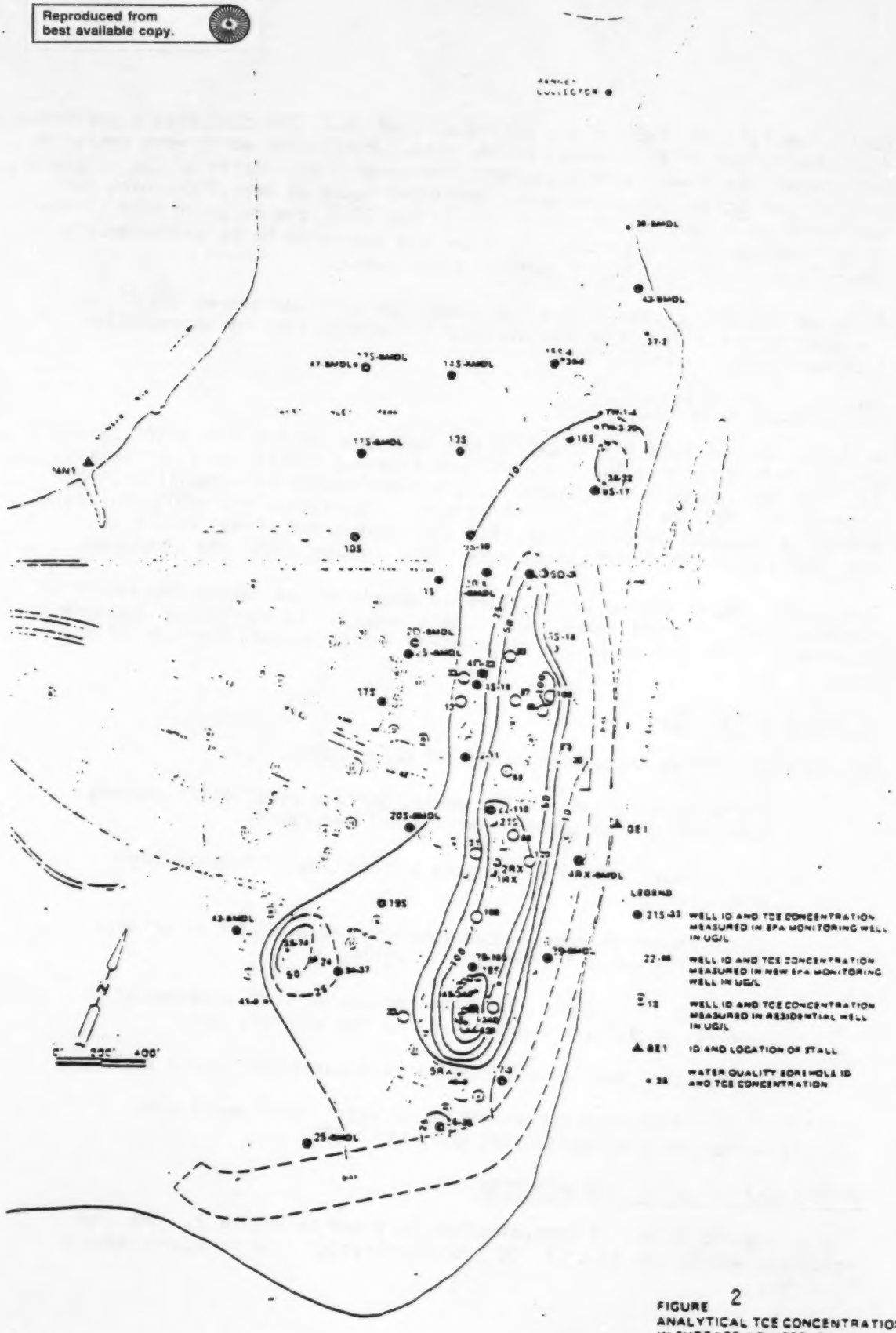
LEGEND
WELL ID AND TCE CONCENTRATION MEASURED IN EPA MONITORING WELL IN UG/L
WELL ID AND TCE CONCENTRATION MEASURED IN NEW EPA MONITORING WELL IN UG/L
WELL ID AND TCE CONCENTRATION MEASURED IN RESIDENTIAL WELL IN UG/L
ID AND LOCATION OF STALL
WATER QUALITY BOREHOLE ID AND TCE CONCENTRATION
0
200'
400'

FIGURE 2
ANALYTICAL TCE CONCENTRATIONS IN SURFACE AQUIFER SAMPLING ROUND 3 APRIL 8-10, 1985

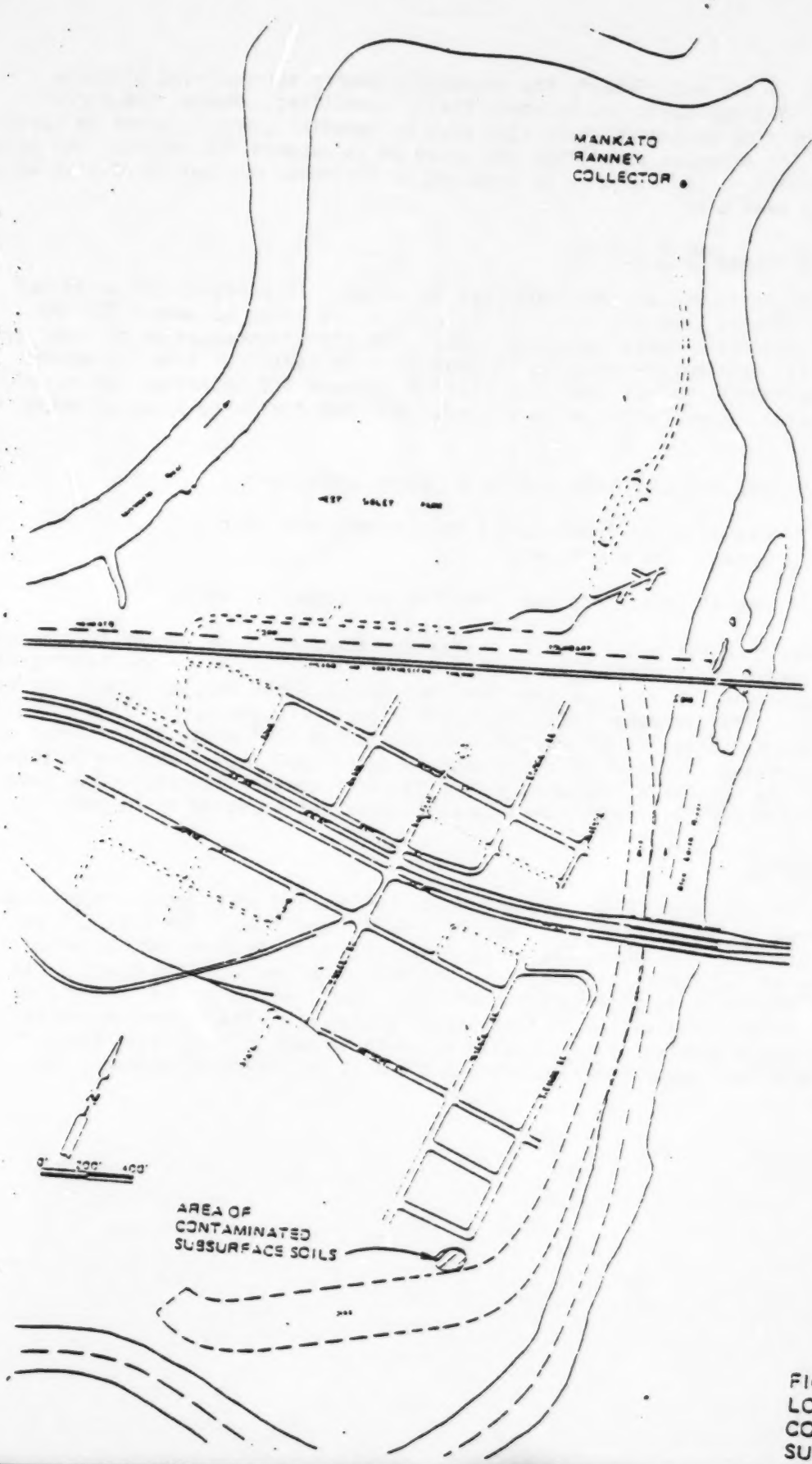

FIGURE 4
LOCATION OF
CONTAMINATED
SUBSURFACE SOILS

Because we did not identify the source(s), source strength and probable future loadings could not be specifically quantified. Hence, the actual exposure risk estimates associated with no remedial actions cannot be quantified. The exposure assessment was based on an assumed TCE influx. The accuracy of this assumption can only be assessed by continued monitoring of site water quality over time.

EXPOSURE ASSESSMENT SUMMARY

An exposure assessment was conducted in the RI. It evaluted the potential health effects that may result if no actions are taken to remove TCE and other volatile organic compounds (VOCs) from the groundwater or to limit the potential contaminant exposure to people in the LeHillier area. Exposure risk estimates reflect potential lifetime average TCE ingestion and dermal absorption rates. Risk estimates were generated for three types of water use:

- Use of water from Mankato's Ranney collector;
- Use of water from a LeHillier private well in the area of the plume; and,
- Use of water from the LeHillier HUD community well.

The resulting estimated overall increased excess lifetime cancer risk associated with use of the Mankato Ranney collector water for ingestion and bathing was approximately 1×10^{-6} (an increased one cancer per 1,000,000 people exposed to TCE). The estimated total increased excess lifetime cancer risk associated with use of LeHillier private well water was 7×10^{-4} which is the total of the increased cancer risk of six cancers per 10,000 people exposed to other VOCs. The estimated increased excess lifetime cancer risk associated with use of the LeHillier HUD community well water was expected to be zero.

ENFORCEMENT

Since no specific TCE sources have been defined and no disposal records exist, no potential responsible parties (PRP) were identified. The U.S. EPA and MPCA did interview local residents concerning past dumping and conducted a survey of industries that may use chlorinated solvents. Consequently, at least six waste disposal sites have been identified in the LeHillier area but there is no recollection of them specifically receiving industrial waste. Small scale dumping of chlorinated solvents by some of the local industries may have been major contributers but there is no direct evidence at this time.

TCE concentrations shown in Figure 3 are typical of the maximum magnitude of groundwater TCE contaminantion.

The analytical results for groundwater samples collected from different depths within boreholes scattered around the contaminated area indicate that groundwater TCE concentrations are highest at the base of the sand and gravel aquifer near the bedrock (St. Lawrence Dolomitic Siltstone) - overburden contact. A possible explanation for this trend is that periodic recharge causes vertical gradients capable of inducing downward contaminant transport. Once the TCE plume reaches the basal unit of the aquifer, its further downward migration is limited by the lower hydraulic conductivity of the bedrock aquiclude when compared to that of the aquifer. At the base of the aquifer, the predominant flow direction is horizontal.

Although TCE concentrations in the upper weathered zone of the St. Lawrence Siltstone underlying the sand and gravel may be elevated, TCE concentrations in the unweathered portion of this formation are expected to be below the analytical method detection limits. TCE concentrations in water samples taken from the deeper bedrock monitoring wells were consistently lower than those in samples from the adjacent shallower bedrock monitoring wells.

A few private bedrock wells in the area are contaminated with TCE (e.g., the concentration of TCE in water taken from a residential well during Round 3 was 130 ug/l TCE). Downward vertical gradients in the bedrock, pumping-induced vertical gradients, the possible poor seating of the casing into the bedrock provide the driving forces and the pathway for downward migration of TCE into the bedrock. A probable pathway for cross contamination between the upper contaminated sand and gravel aquifer and the lower Franconia Sandstone aquifer exists.

The boundaries of the TCE plume have not changed dramatically during the 11 months of RI monitoring in 1984-85. The predicted order-of-magnitude estimates of future TCE concentrations at the Ranney collector (TCE maximum concentration = 0.8 ug/l estimated to occur in 50 years) were developed for the exposure assessment under the no action alternative.

SOIL CONTAMINATION

In addition to the TCE identified in groundwater, petroleum byproduct constituents (ethylbenzene at 18,000 ug/kg, toluene at 2,400 ug/kg, and xylenes at 81,000 ug/kg) were identified in subsurface soils located in a small area at the end of Eleanor Road and adjacent to the Army Corps of Engineers dike as shown in Figure 4. This vicinity was identified as the location of a former disposal area. These compounds were identified in individual wells and are not believed to be distributed throughout the aquifer or as a plume.

SOURCES

Efforts to locate source(s) of the TCE contamination were unsuccessful. The TCE concentrations in the soil and septic system samples were low or below analytical method detection limit. Four subareas showing higher TCE concentrations than those observed in the surrounding area highs were identified and may be possible source regions.

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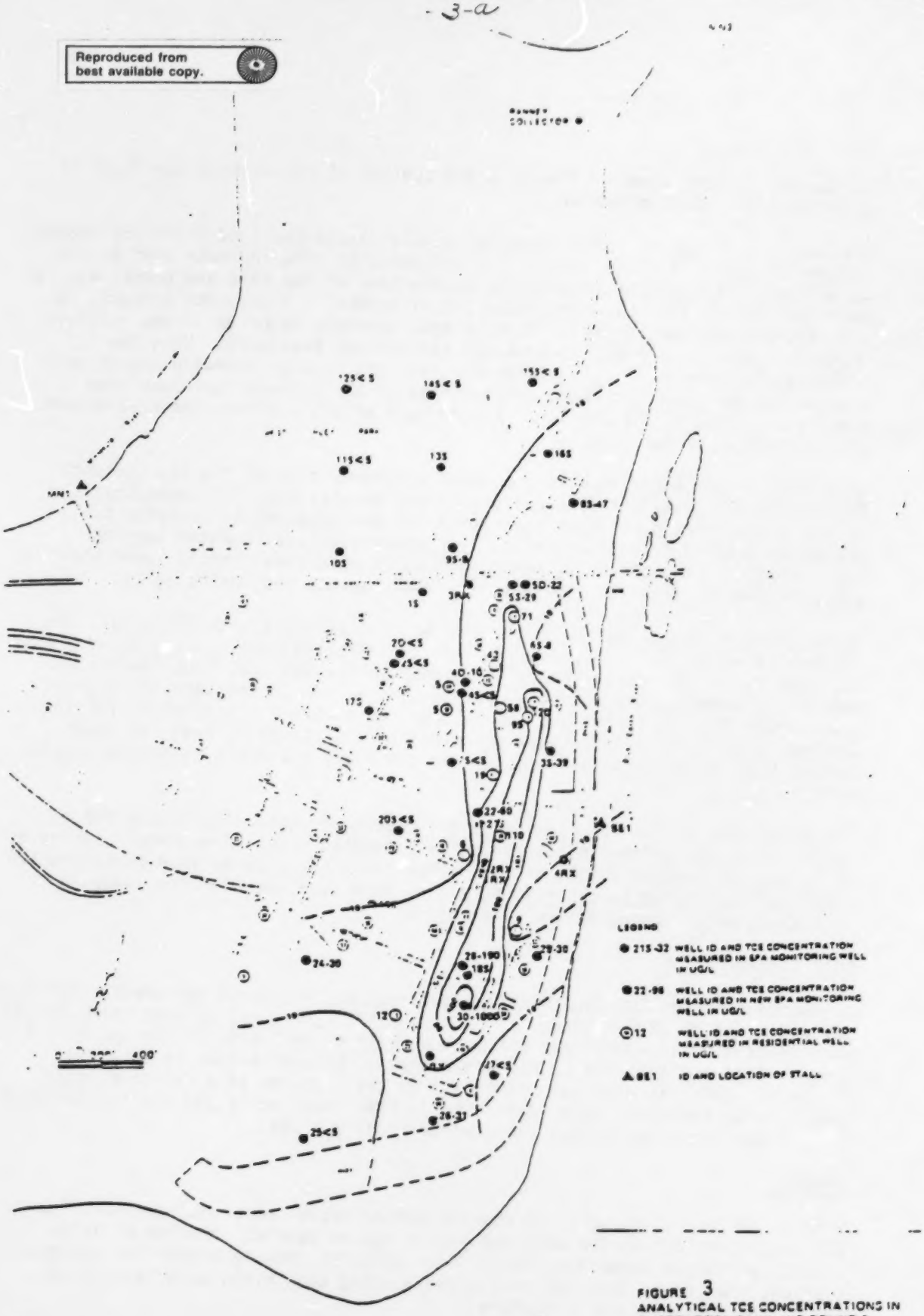
LEGEND
215-32 WELL ID AND TCE CONCENTRATION MEASURED IN EPA MONITORING WELL IN UG/L
22-98 WELL ID AND TCE CONCENTRATION MEASURED IN NEW EPA MONITORING WELL IN UG/L
12 WELL ID AND TCE CONCENTRATION MEASURED IN RESIDENTIAL WELL IN UG/L
SS1 ID AND LOCATION OF STALL

FIGURE 3
ANALYTICAL TCE CONCENTRATIONS IN OVERBURDEN SAMPLING ROUND 2
OCTOBER, 1984

Because we did not identify the source(s), source strength and probable future loadings could not be specifically quantified. Hence, the actual exposure risk estimates associated with no remedial actions cannot be quantified. The exposure assessment was based on an assumed TCE influx. The accuracy of this assumption can only be assessed by continued monitoring of site water quality over time.

EXPOSURE ASSESSMENT SUMMARY

An exposure assessment was conducted in the RI. It evaluted the potential health effects that may result if no actions are taken to remove TCE and other volatile organic compounds (VOCs) from the groundwater or to limit the potential contaminant exposure to people in the LeHillier area. Exposure risk estimates reflect potential lifetime average TCE ingestion and dermal absorption rates. Risk estimates were generated for three types of water use:

- Use of water from Mankato's Ranney collector;
- Use of water from a LeHillier private well in the area of the plume; and,
- Use of water from the LeHillier HUD community well.

The resulting estimated overall increased excess lifetime cancer risk associated with use of the Mankato Ranney collector water for ingestion and bathing was approximately 1×10^{-6} (an increased one cancer per 1,000,000 people exposed to TCE). The estimated total increased excess lifetime cancer risk associated with use of LeHillier private well water was 7×10^{-4} which is the total of the increased cancer risk of six cancers per 10,000 people exposed to other VOCs. The estimated increased excess lifetime cancer risk associated with use of the LeHillier HUD community well water was expected to be zero.

ENFORCEMENT

Since no specific TCE sources have been defined and no disposal records exist, no potential responsible parties (PRP) were identified. The U.S. EPA and MPCA did interview local residents concerning past dumping and conducted a survey of industries that may use chlorinated solvents. Consequently, at least six waste disposal sites have been identified in the LeHillier area but there is no recollection of them specifically receiving industrial waste. Small scale dumping of chlorinated solvents by some of the local industries may have been major contributers but there is no direct evidence at this time.

ALTERNATIVES EVALUATION

The Mankato Ranney collector which supplies 95 percent of the drinking water, is approximately 1,500 feet downgradient of the leading edge of the contaminated groundwater plume. Most residents within the LeHillier area are serviced by a new HUD water system which utilizes a confined deeper bedrock aquifer. A steady state flow and contaminant transport model under an assumed source influx predicts that TCE will reach Mankato's water supply within 20 years. Maximum TCE concentrations of .8 ppb will occur at 50 years. Under assumptions made in the exposure assessment, dermal contact through bathing and ingestion over a 70 year period would result in a 10^{-6} lifetime cancer risk. A sensitivity analysis was also performed on the model where several parameters were varied to determine which parameters have the greatest influence on predicted concentrations in the Ranney collector. The sensitivity analysis showed that the effect of a 100 percent increase in TCE influx is a 100 percent increase in maximum concentrations in Mankato's water supply. Since source strength and possible future loadings were not quantified in our RI, the actual source influx may be much greater than assumed in our exposure assessment, therefore, the actual risks to Mankato's water supply may be greater than 10^{-6}.

The model also assumes a steady state flow. The actual groundwater flow direction and velocity is heavily dependent upon flow stages in the Blue Earth and Minnesota Rivers and is very dynamic in nature. By observing groundwater flow over a 31 month period, the actual net movement of the TCE plume is slowly northward towards the Ranney collector. Since the actual flow is complex and transient (not simple and steady state), formation of a TCE contaminant slug through a sequence of extreme hydrogeological events is a possibility and may result in TCE concentrations that are higher than predicted in our exposure assessment.

Migration of uncontrolled contaminants from an unidentified source may severely impact the water supply for the 29,000 residents of Mankato. Clean-up alternatives ranging from constructing alternate water supplies for Mankato to controlling and cleansing the aquifer were evaluated. During initial alternative development, our Feasibility Study documents that controlling and cleansing the aquifer is more cost-effective than constructing an alternate water supply for Mankato.

REMEDIAL GOALS AND OBJECTIVES

These are the remedial goals and objectives for the LeHillier site:

- Adequately protect the public against exposure to TCE through direct contact or ingestion of groundwater from private and public water supply.

- Adequately protect the public against exposure to TCE released to surface water from the groundwater.

- Adequately protect and minimize damage to the environment from the migration of TCE in the groundwater.

Remedial goals are also expressed in terms of specific concentrations in groundwater and surface water through remedial action. Remedial goals and objectives are expressed in terms of TCE only to simplify discussion. Other volatile organic contaminants identified in groundwater would be addressed by remedial actions directed at the more widespread TCE contamination.

REMEDIAL ALTERNATIVES

Initial steps were to screen every remedial technology conceivable. Only applicable and feasible technologies were further evaluated again for specific engineering, cost, environmental, and institutional criteria consistent with the National Contingency Plan (NCP). The remaining technologies were then combined to form five alternatives (A1-A5) which were screened for the criteria described above. The following are brief descriptions of each alternative considered.

Alternative No. 1 (A-1).

Groundwater Extraction. A-1 involves extraction of the contaminated groundwater plume through adaptation of eight existing U.S. Army Corps of Engineers (COE) groundwater and flood control wells and construction of two new extraction wells, one north and one south of the existing TCE plume. An arrangement of eight existing COE wells pumping at 225 gpm each and two new wells pumping at 500 gpm appears to provide a sufficient overall zone of capture at a reasonable rate of extraction. Groundwater from the COE wells would be conveyed to the existing COE sump by means of the existing gravity collection line. Water from the north well would be conveyed to discharge through a new outfall pipe. Water from the south well would be conveyed to the existing COE gravity collection line.

The arrangement of eight selected COE extraction wells and two new extraction wells in A-1 is intended to serve three purposes:

- The new north well would serve as a blocking well to control migration of the plume toward the Ranney collector.
- The COE wells would generally control westward migration of TCE.
- The new south well would extract TCE contamination near suspected (but undefined) TCE sources near the southern portion of the site.

The goal of extraction under A-1 is to manage migration and rapidly reduce TCE concentration in the groundwater to the Clean Water Act Ambient Water Quality Criteria for ingestion of drinking water for the estimated 10^{-6} excess lifetime cancer risk concentration of 2.8 ug/l. Assuming no active TCE sources contributing to the groundwater, the predicted duration of extraction would be approximately 5 to 10 years according to the modeling of TCE migration.

It is possible that at least one active source of TCE is contributing to groundwater contamination at LeHillier. If this is the case, the groundwater extraction arrangement would control migration and reduce sources but may not achieve the extraction goal of reducing TCE concentration in the aquifer to 2.8 ug/l within the time frame we have estimated. However, aggressive groundwater extraction may help identify and lead to the remediation of TCE sources. If a source of contamination is found, source control actions will be evaluated versus continued pumping and treating.

Groundwater Treatment. A-1 incorporates no treatment of extracted groundwater.

Groundwater Discharge. A-1 involves discharge of extracted groundwater in the COE interceptor into the Blue Earth River through a diffuser pipe placed along the bottom of the river. Groundwater discharged from the north extraction well would be discharged through an outfall located on the west bank of the river. Modeling of groundwater suggests that the maximum TCE concentration of the extracted groundwater from the COE interceptor would be approximately 13 ug/l. Following dilution in the Blue Earth River, the concentration of TCE in the river is expected to be less than the proposed maximum contaminant level (MCL) for trichloroethylene of 5 ug/l and below the Clean Water Act Water Quality Criteria for ingestion of drinking water and organisms for the estimated 10^{-6} excess lifetime cancer risk concentration of 2.8 ug/l.

During the first 6 months to 12 months of extraction system operation, estimates indicate that the extraction system may need to be shut down for brief periods when flow in the river is insufficient to dilute discharged groundwater to the target TCE concentration of 10^{-6} excess lifetime cancer risk of 2.8 ug/l. To maintain a maximum TCE concentration of less than 2.8 ug/l, groundwater discharge would be limited to times when river flow was greater than 19.7 cubic feet per second, or 8,840 gallons per minute.

LeHillier Water Supply. A-1 includes extension of the HUD distribution system to include all LeHillier residential dwellings and private commercial operations affected by the existing TCE plume.

Mankato Water Supply. A-1 does not involve physical changes to the existing Mankato water supply system. A-1 includes monthly monitoring of the Ranney collector discharge for VOCs according to the summary schedule in Table 1.

Alternative No. 2 (A-2).

Groundwater Extraction. A-2 involves the same COE and new groundwater extraction well arrangement and extraction pumping rate as A-1.

The goal of groundwater treatment is to reduce the mass of TCE discharge to the Blue Earth River so that the Clean Water Act Ambient Water Quality Criteria for ingestion of drinking water and lifetime cancer risk concentration of 2.8 ug/l is met. Assuming no active TCE sources contributing to the groundwater, the predicted duration of extraction would be the same as A-1, that is, approximately 5 to 10 years according to the modeling of TCE migration.

It is possible that at least one active source of TCE is contributing to ground water contamination at LeHillier. If this is the case, the groundwater extraction arrangement would control migration and reduce sources but may not achieve the extraction goal of reducing TCE concentration in the aquifer to

2.8 ug/l within the time frame we have estimated. This alternative will aggressively extract contaminants and may lead to identification and eventual remediation of active TCE sources. If a source of contamination is found, source control actions will be evaluted versus continued pumping and treating.

Groundwater Treatment. A-2 incorporates treatment of extracted groundwater from the new south extraction well to remove 98 percent of the TCE by air stripping prior to discharge into the COE interceptor.

The goal of groundwater treatment is to reduce the mass of TCE discharge to the Blue Earth River so that the Clean Water Act Ambient Water Quality Criteria for ingestion of drinking water and lifetime cancer risk concentration of 2.8 ug/l would be met at the consecutive seven day average low flow over a ten year period (Q7,10) river flow.

Based on the predicted estimated maximum TCE concentration in groundwater extracted from the wells which would receive treatment, 98 percent TCE removal would produce a maximum discharge concentration from the COE interceptor system of 3.4 ug/l.

Groundwater Discharge. A-2 involves discharge of extracted treated groundwater to the Blue Earth River through two near-shore outfalls located along the west bank of the river. With the TCE removed from the new south extraction well discharge, the maximum concentration of TCE in the extracted groundwater is estimated at 3.4 ug/l. During the low flow condition represented by the Q7,10 in the Blue Earth River of 10,300 gpm, the maximum estimated concentration of TCE in the river would be 1.7 ug/l, which is less than the Ambient Water Quality Criteria for ingestion of drinking water and organisms for the estimated 10^{-6} excess lifetime cancer risk concentration of 2.8 ug/l.

LeHillier Water Supply. A-2 includes extension of the HUD distribution system to include all LeHillier residential dwellings and private commercial operations affected by the existing TCE plume.

Mankato Water Supply. A-2 does not involve physical changes to the existing Mankato water supply system. A-2 includes monthly monitoring of the Ranney collector discharge for VOCs according to the summary schedule in Table 1.

Alternative No. 3 (A-3).

Groundwater Extraction. A-3 incorporates extraction of contaminated groundwater through one new well installed on the north edge of the existing TCE plume. One well pumping at 1,000 gpm appears to provide a sufficient zone of capture to control or block the northward migration of TCE. The final placement and extraction rate of the blocking well(s) would be established during final design of the remedial action.

The goal of the blocking well is to minimize the migration of TCE toward the Mankato Ranney collector. It is not intended to rapidly reduce the TCE concentration in the sand and gravel aquifer at LeHillier.

Assuming no active TCE sources contributing to the groundwater, the blocking well extraction would eventually reduce TCE concentrations as the TCE plume

moved north and was withdrawn. Based on an ultimate goal of a 10^{-6} excess lifetime cancer risk concentration of 2.8 ug/l in the groundwater, the predicted duration of extraction would be greater than 20 years according to modeling of TCE migration.

It is possible that at least one active source of TCE is contributing to groundwater contamination. If this is the case, the blocking well system would be expected to prevent TCE migration to the Mankato Ranney collector but not to achieve any reduction in TCE concentration in the surficial sand and gravel aquifer in the LeHillier area. Identification and reduction of possible TCE sources would be more difficult than with A-1 or A-2 extraction operations and, therefore, a permanent final remedy to the site may not be achieved.

Groundwater Treatment. A-3 incorporates no treatment of extracted groundwater.

Groundwater Discharge. A-3 involves discharge of extracted groundwater directly to the Blue Earth River through an outfall located on the west bank of the river.

Discharge of extracted groundwater from the single blocking well into the Blue Earth River would result in estimated in stream TCE concentrations considerably below the water quality criterion for the 10^{-6} excess lifetime cancer risk of 2.8 ug/l from the start of the blocking well extraction. Based on the Q7,10 flow in the Blue Earth River, dilution of the groundwater discharge would result in an estimated maximum TCE concentration of 0.84 ug/l in the river.

LeHillier Water Supply. A-3 includes the same actions as A-1 for LeHillier water supply. It includes extension of the HUD distribution system to all LeHillier residential dwellings and private commercial operations affected by the existing TCE plume.

Mankato Water Supply. A-3 does not involve physical changes to the existing Mankato water supply system. A-3 includes monthly monitoring of the Ranney collector discharge for VOCs according to the summary schedule in Table 1.

Alternative No. 4 (A-4)

Groundwater Extraction. A-4 does not involve groundwater extraction or containment.

Groundwater Treatment. A-4 does not involve treatment of extracted groundwater.

Groundwater Discharge. A-4 does not involve discharge of extracted groundwater.

LeHillier Water Supply. A-4 includes the same actions as A-1 for LeHillier water supply. It includes extension of the HUD distribution system to all LeHillier residential dwellings and private commercial operations affected by tne TCE plume.

Mankato Water Supply. A-4 does not involve physical changes to the existing Mankato water supply system. A-4 includes monthly monitoring of the Ranney collector discharge for VOCs according to the summary schedule in Table 1.

Alternative No. 5 (A-5)

A-5 is the no action alternative. Under A-5, no further work of any kind would be done at the site by the U.S. EPA.

ALTERNATIVE MONITORING

Groundwater, surface water, and water supply systems must be monitored as part of all alternatives considered for LeHillier. Monitoring would serve to document the performance of an implemented remedy, direct corrective actions as contingencies in case of remedial failure, and confirm the quality of drinking water supplies.

A schedule of monitoring for VOCs was developed for each remedial alternative as shown in Table 1. The estimated costs for monitoring under each alternative are based on this schedule.

Consistency with Other Environmental Laws

The NCP [40 CFR 300.68] establishes the procedures for determining appropriate remedial actions at Superfund sites. Generally, U.S. EPA will implement remedies that meet the standards of applicable or relevant Federal public health or environmental laws. Other environmental laws and guidance which may be applicable and/or relevant to the remedial alternatives evaluated in the FS are the Clean Water Act, Clean Air Act, and the Resource Conservation and Recovery Act (RCRA).

The Resource Conservation and Recovery Act (RCRA) is not considered to be applicable to the remedial alternatives considered in the FS because of the lack of a hazardous waste "regulated" unit. RCRA was intended to regulate facilities used for the treatment, storage and disposal of hazardous waste. Such a facility does not exist at LeHillier. However, though not applicable, the RCRA Subpart F ground water protection standards are considered relevant in determining the appropriate level of cleanup since the major portion of the aquifer underlying the community is contaminated with TCE and PCE. However, certain procedural aspects of implementing RCRA Subpart F ground water protection standards have not been used because they were developed for hazardous waste facilities, specifically, the RCRA ground water protection standards process for establishing an alternate concentration level (ACL). Instead, a risk management approach supported by the endangerment assessment in the FS, prepared as outlined in the "Guidance on Feasibility Studies Under CERCLA" has been used. The immediate goal of protecting human health and the environment is the same, only the procedural aspects differ. At this point our goal will be to achieve 10^{-6} levels within the aquifer which is considered an acceptable level for drinking water consumption.

As part of alternatives 1, 2, and 3, contaminated groundwater would be withdrawn by extraction wells and would be discharged to the Blue Earth River. Only alternative 2 involves treatment of ground water. The Clean Water Act provisions for regulating the discharge of wastewaters are administered by the State through the National Pollutant Discharge Elimination System (NPDES) program. Under that program, the State establishes effluent discharge limits based on the different criteria: 1.) application of best available technology (BAT) and 2.) protection of water quality by meeting State water quality standards. Water quality based effluent limits would be derived for each contaminant by reviewing accute and chronic toxicity data and the calculating allowable levels in the receiving surface water. For treatment of VOC contaminated groundwater air stripping is considered BAT.

Table 1

SUMMARY OF VOC MONITORING SCHEDULES FOR ASSEMBLED ALTERNATIVES

Sample Description	Assembled Alternative No. 1			Assembled Alternative No. 2			Assembled Alternative No. 3			Assembled Alternative No. 4		
	Period (Years)	Frequency	Number of Samples	Period (Years)	Frequency	Number of Samples	Period (Years)	Frequency	Number of Samples	Period (Years)	Frequency	Number Sampl
1. Extraction Wells												
North Well Discharge	1-2	Monthly	1	1-2	Monthly	1	1-2	Monthly	1	1-5	-	-
	2-5	Quarterly	1	2-5	Quarterly	1	2-5	Quarterly	1	5-20	-	-
	5-10	Quarterly	1	5-10	Quarterly	1	5-20	Quarterly	1	20-30	-	-
South Well Discharge	1-2	Monthly	1	1-2	Monthly	1	1-2	-	-	1-5	-	-
	2-5	Quarterly	1	2-5	Quarterly	1	2-5	-	-	5-20	-	-
	5-10	Quarterly	1	5-10	Quarterly	1	5-20	-	-	20-30	-	-
COE Sump Discharge	1-2	Monthly	1	1-2	Monthly	1	1-2	-	-	1-5	-	-
	2-5	Quarterly	1	2-5	Quarterly	1	2-5	-	-	5-20	-	-
	5-10	Quarterly	1	5-10	Quarterly	1	5-20	-	-	20-30	-	-
2. Blue Earth River	1-2	Monthly	2	1-2	Monthly	2	1-2	Monthly	2	1-5	-	-
	2-5	Quarterly	2	2-5	Quarterly	2	2-5	Quarterly	2	5-20	-	-
	5-10	Quarterly	2	5-10	Quarterly	2	5-20	Quarterly	2	20-30	-	-
3. Monitoring Wells	1-2	Monthly	10	1-2	Monthly	10	1-2	Monthly	16	1-5	Monthly	16
	2-5	Quarterly	10	2-5	Quarterly	10	2-5	Monthly(Quarterly)	7 (6)	5-20	Monthly(Quarterly)	8(6)
	5-10	Quarterly	10	5-10	Quarterly	10	5-20	Monthly(Quarterly)	7 (6)	20-30	Quarterly	16
4. Ranney Collector Effluent	1-2	Monthly	1	1-2	Monthly	1	1-2	Monthly	1	1-5	Monthly	1
	2-5	Monthly	1	2-5	Monthly	1	2-5	Monthly	1	5-20	Monthly	1
	5-10	Quarterly	1	5-10	Quarterly	1	5-20	Monthly	1	20-30	Quarterly	1
5. IRM Well Discharge	1-2	Monthly	-	1-2	Monthly	-	1-2	Monthly	1	1-5	Monthly	1
	2-5	Quarterly	1	2-5	Quarterly	1	2-5	Monthly	1	5-20	Quarterly	1
	5-10	Quarterly	1	5-10	Quarterly	1	5-20	Quarterly	1	20-30	Quarterly	1

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Under alternatives 1, 2, and 3, ambient water quality criteria i.e., less than 10^{-6} risk of increased cancer incidence (2.8 ppb) are being met. However, when a best professional judgement (BPJ) evaluation is performed on all alternatives, only alternative 2 meets the BAT requirements under the Clean Water Act.

Alternative 2 would also result in an air emissions of TCE. Under State emission standards and with the assumed concentrations to be treated by air stripping, no additional treatment of air emissions (e.g., granular activated carbon) treatment will be necessary.

COST ANALYSIS

Estimated capital costs, replacement costs, annual operation and maintenance costs, and present worth for each alternative except no action are presented in Tables 2 to 5.

SELECTION OF RECOMMENDED ALTERNATIVE

This presents the rationale used to select a single recommended alternative for the LeHillier site. The NCP [Section 300.68(i)] requires U.S. EPA to select the "lowest cost alternative that is technologically feasible and reliable, and which effectively mitigates and minimizes damage and provides adequate protection of public health, welfare, or the environment."

ALTERNATIVE COMPARISON

Alternatives A-4 and A-5

The limited action (A-4) and no action (A-5) alternatives are considered ineffective in preventing further contaminant migration and would not mitigate existing TCE contaminant at the site. The exposure assessment and sensitivity analysis presented in the RI/FS reports conclude that there is a potential for exposure of the public to TCE and other volatile contaminants at the site at concentrations that may adversely affect health and welfare. Remedial action is therefore required to reduce or minimize this possible exposure. On the basis of the need for remedial action at the site, the limited action (A-4) and no action (A-5) alternatives are not appropriate at LeHillier and are not carried forward to final selection.

ALTERNATIVE A-3

Alternative A-3 would effectively block further northward migration of TCE toward the Mankato Ranney collector. However, A-3 is not considered an aggressive remedy that would lead to eventual identification or reduction of suspected TCE sources. If active TCE sources exist, restoration of the aquifer to acceptable concentrations may not be achieved for a very long time. Further identification and subsequent remediation of TCE sources may never be achieved.

TABLE 2
COST ESTIMATE SUMMARY
ASSEMBLED ALTERNATIVE: AA-1

COST COMPONENT	CAPITAL COST	ANNUAL O&M COSTS	PRESENT WORTH PERIOD (YRS)	ESTIMATED* PRESENT WORTH
1. TWO EXTRACTION WELLS	$126,000	$12,000	10	$266,000
2. 8 COE WELLS	$154,000	$23,000	10	$374,000
3. DISCHARGE FACILITIES				
A. NORTH WELL	$21,000	$2,500	10	$47,000
B. S. WELL & COE WELLS	$206,000	$19,000	10	$431,000
4. HUD WATER SYSTEM EXT. & WELL ABANDONMENT	$108,000			$161,000
5. MONITORING		VARIABLE	20	$177,000
CONSTR. SUBTOTAL	$615,000			
BID CONTINGENCY (10%)	$62,000			
SCOPE CONTINGENCY (15%)	$92,000			
CONSTR. TOTAL	$769,000			
LEGAL & ADMINISTRATIVE (10%)	$77,000			
TOTAL IMPLEMENTATION COST	$846,000			
ENGINEERING & DESIGN (10%)	$77,000			
TOTAL COST ESTIMATE	$923,000			$1,456,000

* PRESENT WORTH OF O&M COSTS IS DETERMINED FOR A 10% INTEREST RATE . ELECTRICAL COSTS ARE ESCALATED AT 4% .

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TABLE 3
COST ESIMATE SUMMARY
ASSEMBLED ALTERNATIVE: AA-2

COST COMPONENT	CAPITAL COSTS	ANNUAL O&M COSTS	PRESENT WORTH PERIOD (YRS)	ESTIMATED* PRESENT WORTH
1. TWO EXTRACTION WELLS	$126,000	$13,000	10	$274,000
2. 8 COE WELLS	$154,000	$23,000	10	$374,000
3. DISCHARGE FACILITIES				
A. NORTH WELL	$21,000	$2,500	10	$47,000
B. SOUTH WELL & COE WELLS	$9,000	$3,500	10	$35,000
4. AIR STRIPPING	$111,000	$15,000	5	$225,000
5. HUD WATER SYSTEM EXT. & WELL ABANDONMENT	$108,000			$161,000
6. MONITORING		VARIABLE	20	$177,000
CONSTR. SUBTOTAL	$529,000			
BID CONTINGENCY (10%)	$53,000			
SCOPE CONTINGENCY (15%)	$79,000			
CONSTR. TOTAL	$661,000			
LEGAL & ADMINISTRATIVE (10%)	$66,000			
TOTAL IMPLEMENTATION COST	$727,000			
ENGINEERING & DESIGN (10%)	$66,000			
TOTAL COST ESTIMATE	$793,000			$1,293,000

* PRESENT WORTH OF O&M COSTS IS DETERMINED FOR A 10% INTEREST RATE . ELECTRICAL COSTS ARE ESCALATED AT 4% .

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TABLE 4
COST ESTIMATE SUMMARY
ASSEMBLED ALTERNATIVE : AA-3

COST COMPONENT	CAPITAL COSTS	ANNUAL O&M COSTS	PRESENT WORTH PERIOD (YRS)	ESTIMATED * PRESENT WORTH
1. MIGRATION CONTROL (BLOCKING) WELL	$70,000	$9,500	30	$211,000
2. DISCHARGE FACILITIES	$26,000	$2,500	30	$63,000
3. HUD WATER SYSTEM EXT. & WELL ABANDONMENT	$108,000			$161,000
4. MONITORING		VARIABLE	30	$316,000
CONSTR. SUBTOTAL	$204,000			
BID CONTINGENCY (10%)	$20,400			
SCOPE CONTINGENCY (15%)	$30,600			
CONSTR. TOTAL	$255,000			
LEGAL & ADMINISTRATIVE(10%)	$25,500			
TOTAL IMPLEMENTATION COST	$280,500			
ENGINEERING & DESIGN (10%)	$25,500			
TOTAL COST ESTIMATE	$306,000			$751,000

PRESENT WORTH OF O&M COSTS IS DETERMINED FOR A 10% INTEREST RATE .
ELECTRICAL COSTS ARE ESCALATED AT 4% .

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TABLE 5
COST ESTIMATE SUMMARY
ASSEMBLED ALTERNATIVE: AA-4

COST COMPONENT	CAPITAL COST	ANNUAL O&M COSTS	ESTIMATED* PRESENT WORTH
1. HUD WATER SYSTEM EXT. & WELL ABANDONMENT	$108,000		$161,000
2. MONITORING		VARIABLE	$378,000
CONSTR. SUBTOTAL	$108,000		
BID CONTINGENCY (10%)	$10,000		
SCOPE CONTINGENCY (15%)	$16,000		
CONSTR. TOTAL	$134,000		
LEGAL & ADMINISTRATIVE(10%)	$13,500		
TOTAL IMPLEMENTATION COST	$147,500		
ENGINEERING & DESIGN (10%)	$13,500		
TOTAL COST ESTIMATE	$161,000		$539,000

* PRESENT WORTH OF MONITORING COSTS IS DETERMINED FOR A 10% INTEREST RATE OVER A 30 YEAR PERIOD.

A more aggressive TCE extraction alternative is considered necessary to achieve groundwater remedial goals and possible identification for TCE sources. Therefore, alternative A-3 is not selected for implementation.

ALTERNATIVES A-1 AND A-2

Alternatives A-1 and A-2 would mitigate the TCE contamination by aggressively removing the TCE plume within a relatively short period of time. Both alternatives also minimize further TCE migration.

Both A-1 and A-2 provide an agressive groundwater extraction remedy which could lead to the eventual elimination or identification of suspected TCE source areas for future remediation as part of the final remedial action. Both alternatives are in compliance with current environmental laws and regulations. Because estimated capital costs and present worth of A-2 are less than A-1, the recommended alternative is A-2.

RECOMMENDED ALTERNATIVE (A-2)

Recommended alternative A-2 is shown on Figure 5. The discussion below summarizes the reasons for the selection of A-2 as the recommended remedial alternative for the LeHillier site.

A-2 would provide environmental benefit by aggressive extraction of the TCE plume that would eventually reduce TCE concentration in the aquifer to less than the 10^{-6} excess lifetime cancer risk concentration of 2.8 ug/l, which is considered a concentration acceptable for public use. The time to achieve acceptable concentrations in the aquifer has been estimated at 5 to 10 years under the assumptions used to develop A-2.

By the aggressive arrangement of extraction wells, A-2 would also tend to reduce or pinpoint and identify active sources of TCE in the LeHillier area during operation. If identified, source areas could be remediated at some future time.

A-2 complies with applicable and relevant environmental laws, guidances, and standards. In particular, A-2 would comply with groundwater remedial requirements of RCRA 40 CFR 264 Subpart F, surface water quality standards and BAT requirements that would be imposed under tne NPDES program, and air emission standards developed under the Clean Air Act.

A-2 would minimize and would prevent uncontrolled migration of TCE and other site contaminants northward toward the Mankato Ranney collector. The public water supply for the LeHillier community would be made acceptable by extension and connection of all affected residences and commercial establishments to the HUD water supply system.

In terms of estimated cost, A-2 is lower in estimated capital costs and present worth than the comparable alternative, A-1, that also includes the multiwell extraction approach. A-2 is considered the more cost-effective alternative between these two.

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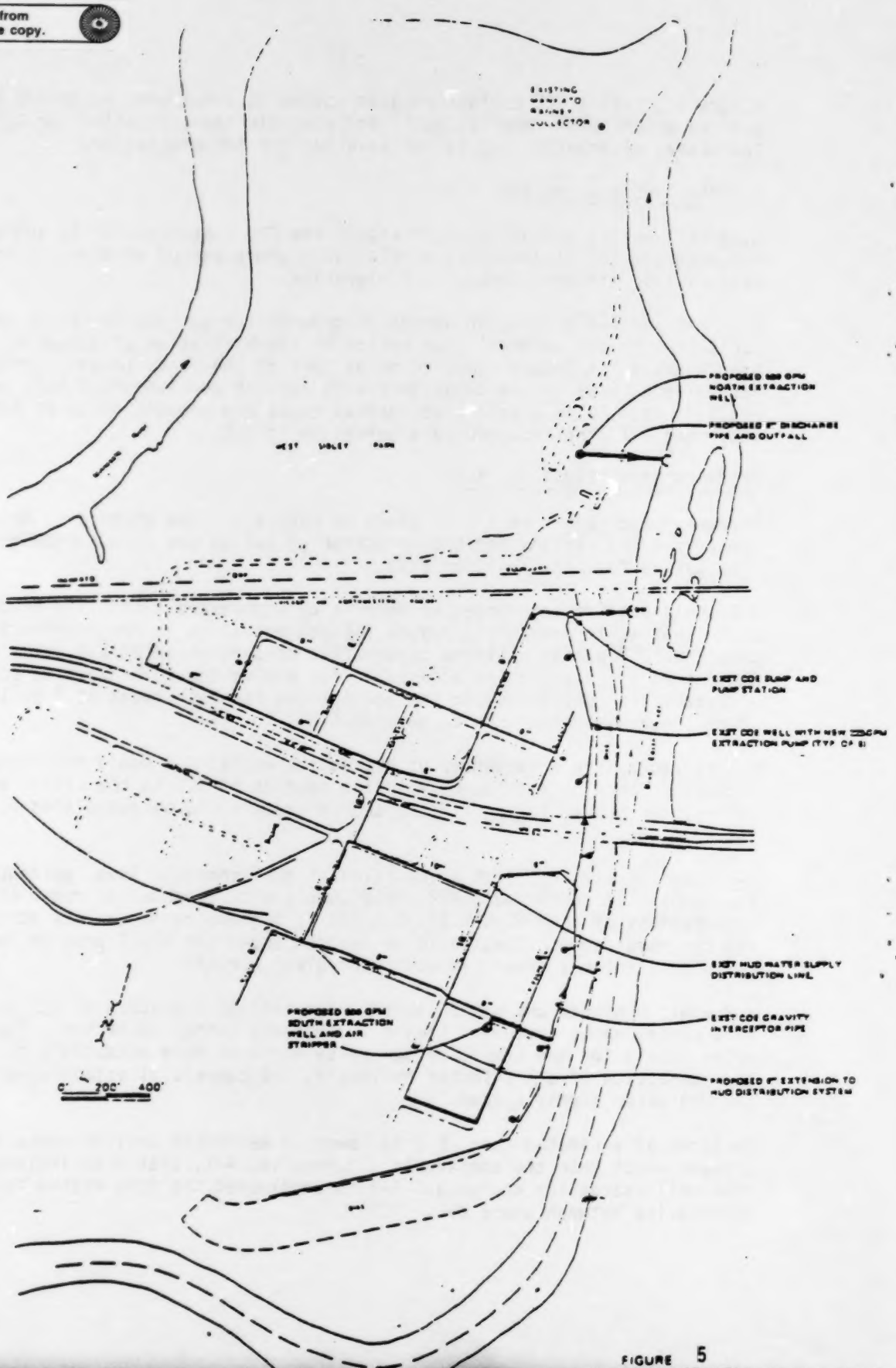

FIGURE 5

OPERATION AND MAINTENANCE (O&M)

Activites would include the routine operation and maintenance of pumps and the air stripper. Other costs would consist of electrical, monitoring, and inspection costs.

O&M of the extraction pumps may be over a ten year period. The air stripper may be removed within 5 years if effluent meets the technical requirements of the NPDES program. It is expected that TCE levels will be significantly lower at this time.

EPA will be responsible for 90 percent of the first year of O&M at a cost of $70,000. The State of Minnesota will continue O&M for the remaining duration which should not exceed 9 years.

COMMUNITY RELATIONS

Community relations in this commumity began with the U.S. EPA bottled water program that was begun October 3, 1983. Official Superfund community relations efforts were initiated in June 1984. On-site discussions were conducted for the Community Relations Plan that was finalized that June. An ad and a press release were used to announce the RI/FS kickoff meeting held June 27, 1985. A repository was established in early July and the first fact sheet, published in September, was placed in the repository as well as being sent to the mailing list.

During the RI there was a certain level of interest maintained due to the difficulty of implementing a HUD water system. The problems were of a local political nature rather than part of the U.S. EPA RI technical work, but kept the project in a high profile. There was some congressional interest in the beginning.

Although this was a federal lead project, the State took the lead on community relations in September through a multi-site cooperative agreement (MSCA) and took over the bottled water program in December.

The results of the RI and the proposed action of the FS were announced at the same time at a August 21, 1985 public meeting. A press release and an ad announcing the proposed action went out in August and the State prepared separate fact sheets for the RI and FS. These, along with the full reports, were added to the repository.

The public meeting was attended by 25 residents and press. The presentation was followed by a few comments and one additional comment came by mail before the September 3, 1985 deadline. With the HUD situation having been resolved the night before our meeting, public response was favorable for our selected remedy. All commenters expressed their desire that the project be implemented as soon as possible.

One commenter also was concerned about water quality impacts on aquatic life when effluent under selected alternative A-2 is discharged into the Blue Earth River. The discharge of all wastewaters are regulated by the State through the NPDES program. Under that program, the State establishes effluent discharge limits for all applicable water quality standards which are developed in a NPDES permit. Parameters to be monitored will be designated by the State dependent upon stream classification and anticipated effluent characteristics. It is U.S. EPA and the State's intent to monitor and comply with all effluent limits applicable to this site. This may include other parameters such as dissolved oxygen and temperature.

SCHEDULE

Because of the uncertainty of reauthorization of Superfund, Federal design and construction funds will not be readily available. The State of Minnesota has expressed a willingness to continue into design phase using State Superfund monies with the understanding that use of their fund will be considered part of their 10 percent match in construction. A Cooperative Agreement has been prepared and submitted to the Region for approval.

Upon approval completion of design could be achieved within a six month period. If Federal funds are available, the construction could begin in the third quarter fiscal year 86 (FY86). The following schedule is contingent on the above.

October 22, 1985	MPCA will formally request that its board approve the selected remedy and authorize use of State funds to implement design phase of LeHillier project.
November 1985	Initiate design phase.
May 1986	Completion of design phase.
June 1986	Start construction of remedy.

FUTURE ACTIONS

Besides managing contaminant migration, this action will control and agressively reduce continuing sources, if any, until the groundwater reaches drinking water quality. By periodic monitoring groundwater quality, operational data will be used by U.S. EPA and the State of Minnesota to evaluate performance and assess the likelihood of reaching our goal of 10^{-6} lifetime cancer risk levels for TCE (2.8 ppb). We estimate that our goal can be achieved within five years if no continuing source exists. If continuing sources still exist after five years, we could achieve our goal within ten years by either continuing the aggressive pumping action and/or installing source controls as necessary.